REMARKS

I. Introduction

In response to the Office Action dated March 26, 2007, which was made final, and in conjunction with the Request for Continued Examination (RCE) submitted herewith, claims 1, 4 and 9 have been amended. Claims 1-14 remain in the application. Re-examination and re-consideration of the application, as amended, is requested.

II. Interview Summary

Record is made of a telephone interview that took place on May 31, 2007 between Examiner JeanGlaude and Applicants' attorney. During the interview, the claim rejections were discussed, and certain claim amendments were suggested, but no agreement was reached.

III. Prior Art Rejections

A. The Office Action Rejections

On pages 2-4 of the Office Action, claims 1-14 were rejected under 35 U.S.C. §102(b) as being anticipated by J. Yu et al., "Adaptive quantization for one-bit sigma-delta modulation," IEE Proceedings-G, Vol. 139, No. 1, February 1992, pages 39-44 (Yu).

Applicants' attorney respectfully traverses the rejections in view of the amended claims above and the arguments below.

B. The Yu Reference

Yu describes adaptive quantization for one-bit sigma-delta modulation. A fixed step size usually is used for a quantizer in a sigma-delta modulator or noise shaper, but it cannot always match input signals adequately if they are nonstationary, as in the case of music. An attempt at introducing adaptive quantisers, based on a digital maximum-magnitude technique, into 1-bit sigma-delta modulators has been made, although the basic idea appeared about two decades ago. The initial results show it to be a promising technique. The dynamic range of the sigma-delta modulator can be effectively increased by using an adaptive quantiser, and the signal/noise ratio is nearly independent of input level for sine wave inputs. This advantage may increase future applications of sigma-delta modulators.

C. The Applicants' Invention is Patentable Over the Yu Reference

The Applicants' claimed invention is patentable over the Yu reference, because the claims contain limitations not taught by the Yu reference.

Applicants' claimed invention involves adaptive modulation that includes generating a binary output signal from an analog input signal using a single quantization bit in a one-bit modulator that includes a quantizer and generating a scaling signal for scaling a step-size of the modulator using multiple quantization bits in a multiple-bit adapter, wherein the step-size is adapted based on an estimate of an absolute value of an input signal to the quantizer.

The Yu reference, on the other hand, does not describe a similar structure for the adapter. Instead, Yu uses the output from the quantizer to alter or scale the step-size of the quantizer. See, for example, FIG. 4 on page 41 of Yu. Specifically, Yu finds the maximum magnitude of the output q(n) from the quantizer, as an estimate of the maximum magnitude of the input x(n), and then uses that value to adapt the step size of the quantizer.

In Applicants' invention, however, the scaling signal d(n) is an estimation of the absolute value of the signal p(n) output from the integrator, before quantization. See, for example, FIG. 1A of Applicants' specification.

Specifically, as described Applicants' specification, the scaling signal d(n) is generated by filtering an error signal e(n), wherein the error signal e(n) represents the difference between the input signal x(n) and an encoding signal v(n). The encoding signal v(n), in turn, is generated by multiplying a binary output signal y(n) by the scaling signal d(n), wherein the binary output signal y(n) is generated by a quantizer from the signal p(n) and the scaling signal d(n) is generated by the adapter using an estimation of the absolute value of the signal p(n) output from the integrator and input to the quantizer. The scaling signal d(n) is then used to scale the step-size of the modulator.

Yu also differs from Applicants' invention in that it adapts the quantization step-size by approximating the variance of the input signal through measuring its peak values for each fixed-length time windows, which means that the adaptation is not instantaneous. Applicants' invention, on the other hand, implements an instantaneous and sample-by-sample adaptation to the quantization step-size, which makes it suitable for tracking highly varying signals, such as speech signals.

Thus, the Yu reference does not anticipate or render obvious Applicants' claimed invention. Moreover, the various elements of Applicants' claimed invention together provide operational advantages over the Yu reference. In addition, Applicants' invention solves problems not recognized by the Yu reference.

Thus, Applicants' attorney submits that independent claims 1 and 9 are allowable over the Yu reference. Further, dependent claims 2-8 and 10-14 are submitted to be allowable over the Yu reference in the same manner, because they are dependent on independent claims 1 and 9, respectively, and thus contain all the limitations of the independent claims. In addition, dependent claims 2-8 and 10-14 recite additional novel elements not shown by the Yu reference.

IV. Conclusion

In view of the above, it is submitted that this application is now in good order for allowance and such allowance is respectfully solicited.

Should the Examiner believe minor matters still remain that can be resolved in a telephone interview, the Examiner is urged to call Applicants' undersigned attorney.

Respectfully submitted,

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